#2

# LOW FREQUENCY
# OSCILLATOR

F99 Bomarc

## Model 420-C

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KROHN-HITE INSTRUMENT COMPANY

CAMBRIDGE 39, MASS., U. S. A.

# LOW FREQUENCY

# OSCILLATOR

## Model 420-C

## INSTRUCTIONS

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**Manufactured by**

**KROHN-HITE INSTRUMENT COMPANY**

**CAMBRIDGE 39, MASS., U. S. A.**

FIGURE 1–MODEL 420-C LOW FREQUENCY OSCILLATOR

# LOW FREQUENCY OSCILLATOR

## Model 420-C

## TECHNICAL SUMMARY

POWER REQUIREMENTS:

Source ..... 105-125 volts, 50-60 cps.
Consumption ..... 65 watts
Fuse Protection ..... 1 ampere (slo-blo)

FREQUENCY RANGE: 0.35 to 52,000 cps.

| Band | Multiplier | Frequency |
|---|---|---|
| 1 | 1/10 | 0.35 - 5.2 |
| 2 | 1 | 3.5 - 52 |
| 3 | 10 | 35 - 520 |
| 4 | 100 | 350 - 5,200 |
| 5 | 1000 | 3,500 - 52,000 |

FREQUENCY DIAL: Calibrated logarithmically from 3.5 to 52, controlled by a 5/1 vernier.

FREQUENCY ACCURACY: Calibration ±2%, drift including initial warm-up is less than 1%, drift with ±10% change in line voltage is less than ±0.05%.

SINE WAVE OUTPUT:

VOLTAGE: Maximum at least 10 volts rms., adjustable continuously.

LOAD: Minimum - 1000 ohms. See "INSTALLATION AND OPERATION"

AMPLITUDE: Varies less than ±1 db over the frequency range from 0.35 to 52,000 cps.

DISTORTION: Less than 1% at any setting of output voltage control.

HUM: Less than 0.1% at any setting of output voltage control.

SQUARE WAVE OUTPUT:

VOLTAGE: At least 10 volts peak to peak.

LOAD: Minimum - 10,000 ohms.

RISE TIME: 0.5 to 1 microsecond on band 5; 1 to 2 microseconds on bands 1 through 4.

FORM: Standard rack panel, sturdy metal cabinet, overall dimensions 19" wide, 8-3/4" high, 9" deep. Weight - 25 lbs.

TUBE COMPLEMENT: 4-6SL7-GT, 2-6V6-GT, 1-6SN7-GTA, 1-tSR7, 1-6AX5-GT.

## DESCRIPTION

The Model 420-C LOW FREQUENCY OSCILLATOR, shown in Figure 1, is a reliable source of sine and square waves at any frequency between 0.35 and 52,000 cycles per second. It operates from an a-c source of 105 to 125 volts, 50 to 60 cycles per second. An integral power supply furnishes the heater voltages and regulated center tap d-c voltages required for operation.

Figure 2 shows the essential units of the Oscillator in block diagram form. The network section contains the frequency determining parameters, which are selected by the frequency dial multiplier switch. A modified RC bridge type circuit is used. The main and AVC amplifiers provide the required signals for the bridge elements. The tuning control is a dual tapered precision potentiometer, which varies the time constants of the network. The sine wave output is maintained very nearly constant by the AVC element in conjunction with the AVC amplifier which applies a voltage to one of the bridge elements.

The sine wave output is controlled by a logarithmically tapered potentiometer directly on the output to maintain hum and distortion in constant ratio to the output sine wave voltage. The square wave output is obtained directly from the square wave generator, which is driven by the sine wave signal.

## INSTALLATION AND OPERATION

The Model 420-C LOW FREQUENCY OSCILLATOR is completely checked and then carefully packed for shipment to insure you of an instrument that is ready for operation. The Oscillator is easy to operate and requires no initial warm-up period or adjustment.

There are only three front panel controls in addition to the "ON-OFF" switch.

The TUNING control selects the output frequency as read on a single scale, illuminated dial, which is engraved logarithmically from 3.5 to 52 and calibrated directly in cycles per second.

The FREQUENCY DIAL MULTIPLIER switch selects the proper multiplying factor for all the five bands, each of which covers a frequency range of 15 to 1 with 50% overlap.

The sine wave RMS VOLTS control is logarithmically tapered and adjusts the level of the sine wave output as read directly in rms. volts on the calaibrated scale. This scale indicates the unloaded output and reads approximately 20% high when a 5,000 ohm load is applied.

A minimum load of 1,000 ohms is specified to insure low distortion when the RMS VOLTS control is at or near the maximum setting. A lower impedance load will not damage the instrument. When the RMS VOLTS control is operated at reduced level a lower impedance load may be used without increasing the distortion.

## MAINTENANCE

All the components in the Model 420-C are of the highest quality and should have a long trouble-free life since they are operated well below their manufacturer's rating. The following procedure may facilitate locating the source of trouble if the Oscillator does not function properly.

A One-Ampere (slo-blo) cartridge fuse, located in the back of the chassis, is used in the primary circuit of the power transformer to protect the power supply components from short circuits. The rating of this fuse was selected for proper protection of the instrument and should be replaced with the same type and rating.

If a fuse failure is detected the following procedure is recommended before replacing the fuse.

(a) Check for a faulty rectifier tube, 6AX5-GT.

(b) Short circuits in the 4MFD filter condensers, C-18 and C-19 used in the unregulated portion of the power supply, can best be detected by connecting an ohmeter across the terminals directly.

(c) An electronically regulated center tap power supply is used in the Model 420-C to provide +200 volts and -200 volts with respect to the chassis or ground. One convenient test point for the +200 volts is the cathode of the 6SL7-GT (V7, pin 2). A convenient test point for the -200 volts is the negative side of the 4MFD filter condensers, C-18 and C-19. If a short to ground exists on either regulated voltage buss, check all the tie points connected to it.

(d) The d-c resistance of the power transformer primary should be 4.5 ohms. A much lower resistance probably indicates a shorted primary.

The likeliest source of failure is the vacuum tubes since they have in inherently shorter life. Check first to see if all the tubes are inserted securely in the sockets, as it is possible for them to be loosened in shipment. At the same time note if each tube's filament is lit. If the unit then fails to operate properly and the correct plate and heater supply voltages are present, check the possibility of a faulty tube. Obtain a new 6SN7-GTA *, 6SL7-GT, 6V6-GT, and 6SR7, and then one at a time, substitute the new tube in each position in the oscillator where it is used. The location of each vacuum tube is clearly marked on the chassis adjacent to the tube.

* Do not use a 6SN7-GT in place of a 6SB7-GTA since the maximum heater-cathode voltage rating of the type GT is inadequate.

The AVC element, I-1, may be checked by removing it from the socket and connecting an ohmeter across its contacts. A resistance less than 200 ohms or greater than 1,000 ohms probably indicates a defective element. I-1 is a conventional 3 watt 115 volt incandescent bulb with a double bayonet base. If any difficulty is experienced in obtaining a replacement, write to our Service Department. If it is necessary to substitute a new element, the setting of P-1 may have to be changed. To check this, set the sine wave RMS VOLTS control on the panel to 10 volts and measure the voltage across the output terminals with a high impedance meter or oscilloscope. Adjust P-1 to obtain an output of 10 volts.

In most cases, one of these substitutions will affect a cure. If, however, this approach does not help, a more detailed test must be made. Location of components to check can be facilitated by reference to the schematic, Figure 5, and the top and bottom views, Figures 3 and 4. In addition, Figure 6 provides a vacuum tube voltage chart which gives the correct operating voltage on every pin of each tube. Any appreciable discrepancy between the existing voltage as measured and the correct one, as shown in Figure 6, should be investigated fully.

## SERVICE

KROHN-HITE Instruments are designed and manufactured in accordance with sound engineering practices, and should give long trouble-free service under normal operating conditions. If your Oscillator fails to provide satisfactory service and you are unable to locate the source of trouble, write to our Service Department giving all the information available concerning the failure.

Do not return the instrument without our written authorization, for in most cases we will be able to supply you with the information necessary to repair the Oscillator and thus avoid the transportation problems and costs. When it becomes necessary to return the instrument to our factory, kindly pack it carefully and ship it to us via express, prepaid.

## WARRANTY

KROHN-HITE Instruments are conservatively designed to provide continuous reliable service under normal laboratory conditions. The material and workmanship in every instrument is guaranteed for one year from the date of purchase. Any instrument developing defects during this period will be repaired or defective parts will be replaced without charge when the failure is the result of defective material or workmanship. Our warranty does not apply to vacuum tubes.

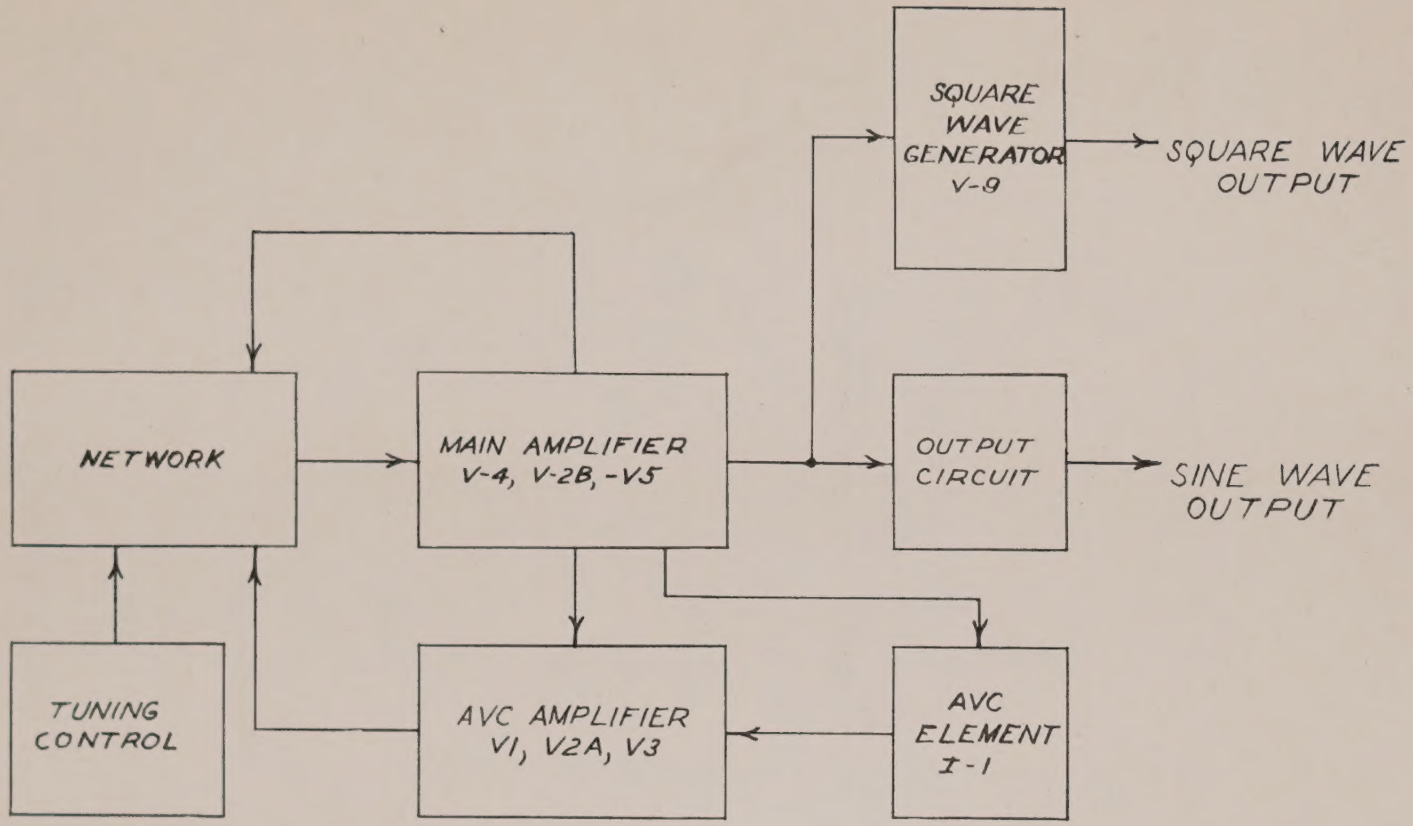



FIGURE 2 – BLOCK DIAGRAM

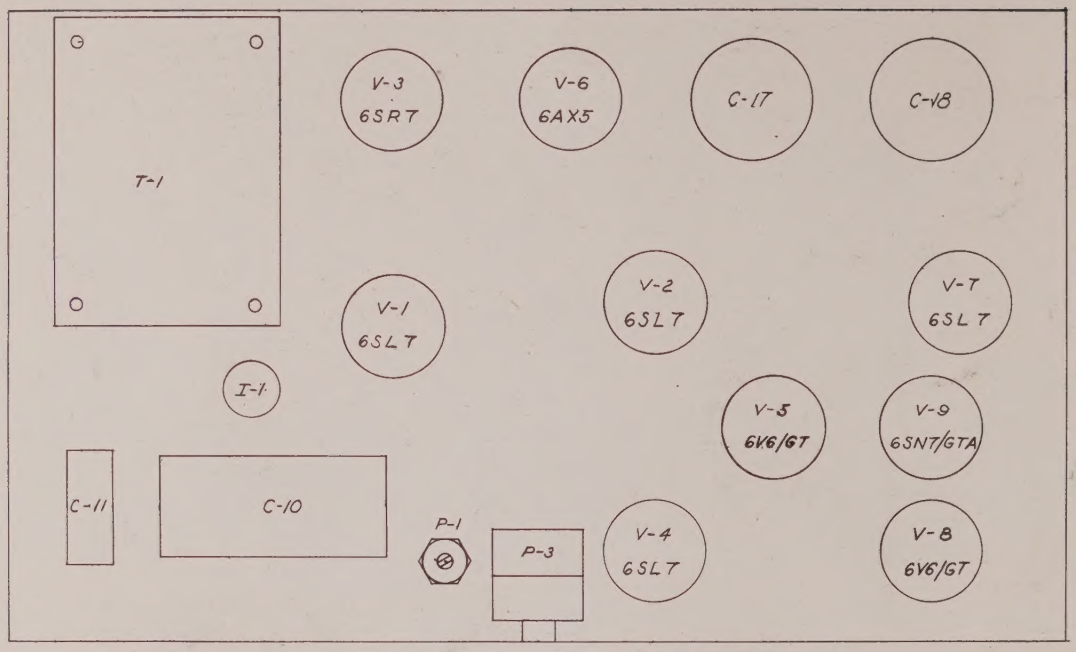



FIGURE 3 – TOP VIEW OF CHASSIS

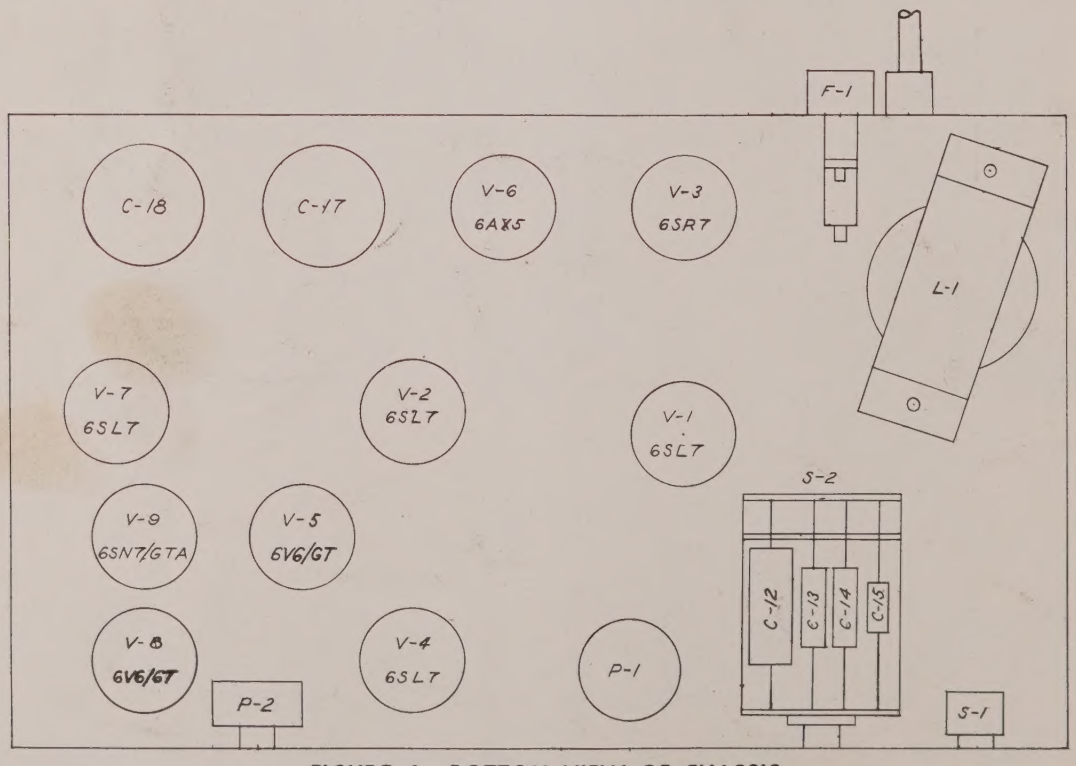
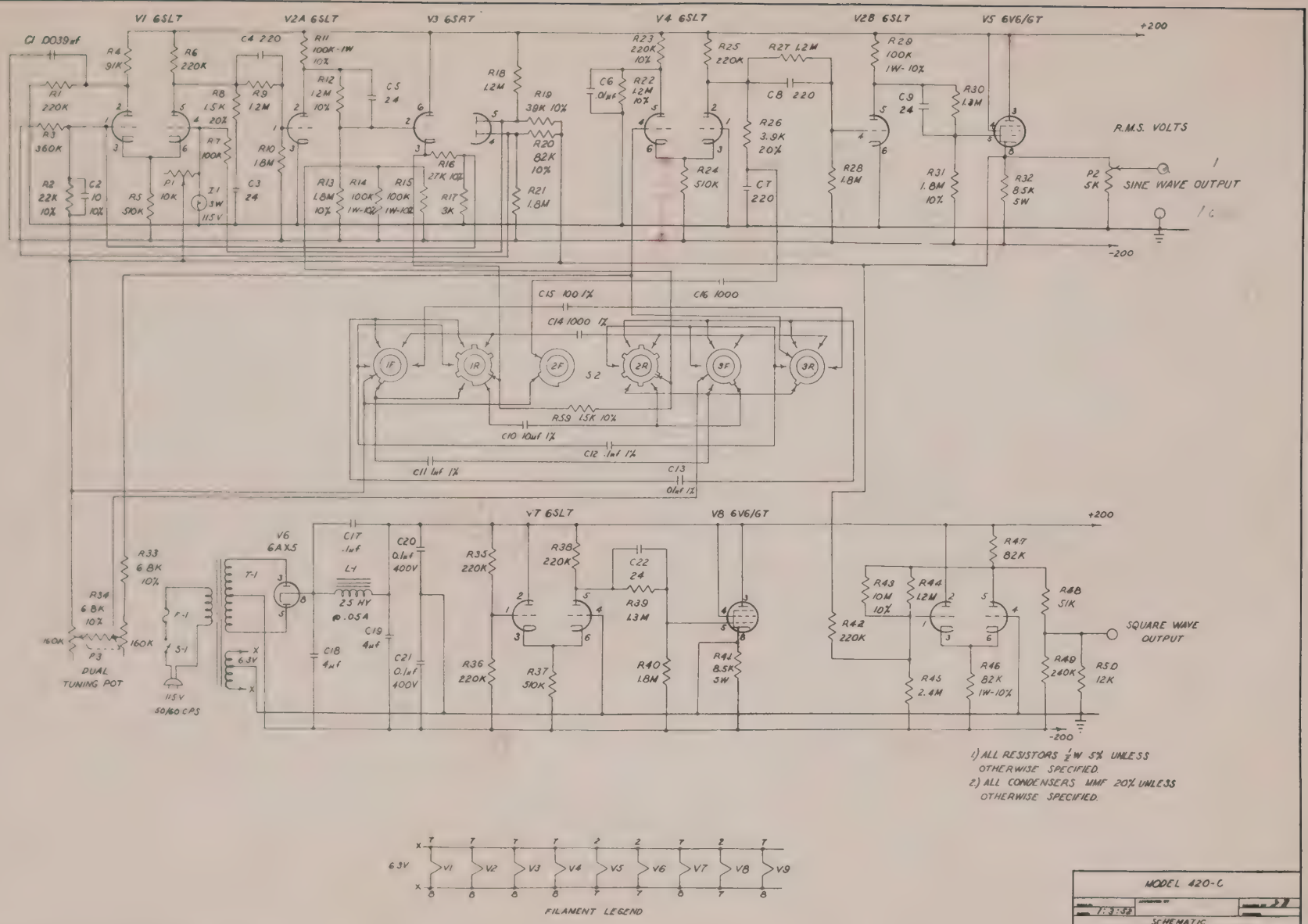



FIGURE 4 – BOTTOM VIEW OF CHASSIS




1) ALL RESISTORS $\frac{1}{2}$W 5% UNLESS OTHERWISE SPECIFIED.
2) ALL CONDENSERS MMF 20% UNLESS OTHERWISE SPECIFIED.

MODEL 420-C

SCHEMATIC
LOW FREQUENCY OSCILLATOR

KROHN-HITE INSTRUMENT CO.
CAMBRIDGE, MASS., U.S.A.

420-C-1

FIGURE 5

## VACUUM TUBE SOCKET VOLTAGES

Oscillator Output Frequency Approximately 200 cps.

D-C Voltages are measured to ground with 20,000 ohms/volt voltmeter

Line Voltage 115 Volts, 60 cps. Y..... 3 volts a-c

| TUBE No. | TUBE Type | PIN NUMBER | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| V1 | 6SL7-GT | 0 | +125 | +1.8 | 0 | +125 | +1.8 | Y | Y |
| V2 | 6SL7-GT | -1 | +115 | 0 | -1 | +115 | 0 | Y | Y |
| V3 | 6SR7 | -- | -7 | +.5 | -6 | -0.4 | +200 | Y | Y |
| V4 | 6SL7-GT | 0 | +125 | +1.8 | 0 | +125 | +1.8 | Y | Y |
| V5 | 6V6-GT | -- | Y | +200 | +200 | -13 | -- | Y | 0 |
| V6 | 6AX5-GT | -- | Y | -- | -- | -- | -- | Y | +220 |
| V7 | 6SL7-GT | -1 | +200 | +1.4 | 0 | +120 | +1.4 | Y | Y |
| V8 | 6V6-GT | -- | Y | +200 | +200 | -13 | -- | Y | 0 |
| V9 | 6SN7-GTA | -5 | +200 | +5 | 0 | +45 | +5 | Y | Y |

FIGURE 6

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